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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Shuttlecocks

We, THE CARLTON TYRE SAVING COMPANY LIMITED of Shire Hill, Saffron Walden, Essex, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to shuttlecocks.

Over many years shuttlecocks have been made which comprise feathers set into a substantially hemispherical member made of cork or other suitable material and called the striking cap. However, such shuttlecocks are both expensive to manufacture and fragile and hence many attempts have been made to use synthetic materials in place of the feathers. Thus in recent years many shuttlecocks have been made which comprise a skirt of moulded plastic which is secured to a striking cap. Such shuttlecocks will hereinafter be termed "moulded shuttlecocks".

It has been found that some difficulty is experienced in employing cork striking caps with such moulded plastic skirts and consequently attempts have been made to employ synthetic materials for the striking caps of moulded shuttlecocks. However, most synthetic materials are inferior to cork from the point of view of lightness and general feel. We have found that great advantages result from the use of expanded polyvinyl chloride which we have been able to make with a suitable mass and resilience for use as a shuttlecock striking cap and, moreover, the material can be arranged to have surface characteristics which are appropriate to such a cap to provide the desired feel and grip.

An object of this invention is to provide a shuttlecock having a moulded skirt structure and a striking cap made of expanded plastics material including improved means whereby the cap is secured to the skirt structure.

According to one feature of the invention the shuttlecock comprises a moulded skirt

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structure comprising a flared array of stems supporting the vane area of the shuttlecock at the wider end of said array of stems and a stem extension collar extending from the narrower end of said array of stems away from the said vane area, and a striking cap surrounding and engaging with the stem extension collar and made of expanded plastics material which has the property of shrinkage characterised in that said stem extension collar has outside dimensions which are less at a section adjacent said flared stems than at a section more remote from said flared stems.

According to another feature of the invention there is provided a method of manufacturing a shuttlecock having a moulded skirt structure comprising a flared array of stems supporting the vane area of the shuttlecock at the wider end of said array of stems and a stem extension collar extending from the narrower end of said array of stems away from said vane area, characterised in the steps of forming said stem extension collar with outside dimensions which are less at a section adjacent said flared stems than at a section more remote from said flared stems, applying a striking cap made of expanded plastics material which has the property of shrinkage to surround said stem extension collar and allowing the expanded plastics material of said striking cap to shrink to engage said stem extension collar.

In one embodiment of the invention the end of the stem extension collar remote from said flared stems is flared outwardly, and in another embodiment of the invention said end of the stem extension collar is rolled over outwardly. Preferably said expanded plastics material is expanded polyvinyl chloride.

We have found that expanded polyvinyl chloride has the property of considerable shrinkage, the rate of shrinkage decreasing with time. In this invention use is made of this property of shrinkage by suitable design of the stem extension collar, to secure the

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striking cap of a shuttlecock to its skirt structure. Preferably the striking cap is applied to the stem extension collar within about one month of the manufacture of the material thereof during which time shrinkage of said material is marked, and the material thus shrinks over the larger outside diameter portion of the stem extension collar. The striking cap thereby becomes secured to the collar without necessarily using any form of adhesive.

In order that the invention may be clearly understood and readily carried into effect it will now be more fully described with reference to the accompanying drawings in which:—

Figure 1 shows, on an enlarged scale, a shuttlecock in accordance with one embodiment of the invention, the skirt and cap being shown apart for clarity, and the shuttlecock cap being shown in section,

Figure 2 shows in section the cap and a part of the skirt of the shuttlecock of Figure 1, and

Figure 3 shows the cap engaging end of a skirt, partly in section, of a shuttlecock in accordance with another embodiment of the invention.

The shuttlecock shown in Figures 1 and 2 comprises a moulded nylon skirt structure which includes a flared array of stems 1. By way of example sixteen stems 1 may be provided. The array of stems 1 supports at its wider end a vane area 2 shown in dotted outline in Figure 1. The ends of the stems 1 remote from the vane area 2 merge into an end ring 3, and the skirt structure also includes a stem extension collar 4 which extends from the end ring 3 away from the vane area of the skirt. The stems 1, vane area 2, end ring 3 and stem extension collar 4 are all moulded together in one operation together with a strengthening rib 5 interconnecting the stems 1 as shown. Alternatively, there may be more than one strengthening rib, or no strengthening ribs.

As can be seen in Figures 1 and 2 the stem extension collar 4 is predominantly in the form of a hollow cylindrical tube, which may, for example, be approximately 1 centimetre in length and which has an outer diameter which is less than the outer diameter of the end ring 3. The end of the stem extension collar 4 remote from the end ring 3 is rolled over outwardly to form a rim 6, as seen most clearly in Figure 2. In this way the outside diameter of the stem extension collar 4 at said end is made greater than the outside diameter of said collar 4 adjacent the end ring 3. The end of the collar 4 is rolled over to form the rim 6 after the moulding operation. By way of example the outer diameter of the cylindrical part of the collar 4 adjacent the end ring 3 may be 1.3 centimetres, and the outside diameter of the rim 6 may be 1.7 centimetres.

The shuttlecock also comprises a striking cap 7 of expanded polyvinyl chloride, which is initially formed with a recess 8 therein having a uniform diameter which is sufficiently large to accommodate the outer diameter of the rim 6. The edge of the recess 8 is chamfered as indicated by reference 9 in Figure 1. The striking cap 7 is applied to the skirt structure by inserting the stem extension collar 4 into the recess 8. Thus initially the material of the cap is not in engagement with the smaller diameter part of the collar 4. The shuttlecock thus formed is then left for a suitable time, which may be a few days, and during this time the expanded polyvinyl chloride of the cap 7 shrinks and in so doing the material of said cap 7 closes around the rim 6, and comes into engagement with the smaller diameter part of the stem extension collar 4. The shape of the recess 8 in the cap 7 thus becomes that shown in Figures 1 and 2 so that the material of the cap 7 holds the stem extension collar 4 within said recess 8 without the necessary use of any form of adhesive. In the course of time, as the expanded polyvinyl chloride of the cap 7 shrinks more and more, the cap becomes more and more firmly secured to the skirt structure.

In the case of expanded polyvinyl chloride it is found that the rate of shrinkage of the material decreases with time, but is marked for about one month after its manufacture. Hence, preferably a cap made of expanded polyvinyl chloride is applied to the skirt structure of a shuttlecock in accordance with this invention within one month of its manufacture.

In another embodiment of the invention, instead of forming the end of the stem extension collar 4 with a rolled over rim 6, said end is flared outwardly after the skirt structure has been moulded, for example, by inserting a suitable tapered tool in said end. Such an embodiment is shown in Figure 3 in which like reference numerals to those in Figures 1 and 2 are used for corresponding parts. The flared end of the stem extension collar is indicated by reference 10 in Figure 3. A striking cap similar to that already described with reference to Figures 1 and 2 is applied over the stem extension collar 4 and the material thereof is allowed to shrink to close over the flared end 10, thereby securing said striking cap to the skirt structure.

Although the invention has been described with particular reference to the two embodiments thereof shown in the drawings, the stem extension collar may be formed in other ways so that it has outside dimensions which are less at a section adjacent the flared stems of the skirt than at a section more remote from said stems to enable a striking cap to become secured to said stem extension collar by the material of said cap shrinking over said more remote section. Moreover, although the invention has been described with particular

reference to shuttlecocks having striking caps of expanded polyvinyl chloride, other expanded plastics materials having the property of shrinkage may be employed. Further, the
 5 recess 8 in the striking cap may initially be formed with a small annular locating recess for accomodating the larger diameter section of the stem extension collar. The cap can then
 10 be forced over the larger diameter section of the stem extension collar until this locates in the locating recess. Thereafter shrinkage of the material of the cap causes said cap to become firmly secured to the stem extension collar.

WHAT WE CLAIM IS:—

- 15 1. A shuttlecock comprising a moulded skirt structure comprising a flared array of stems supporting the vane area of the shuttlecock at the wider end of said array, and a stem extension collar extending from the narrower
 20 end of said array of stems away from said vane area, and a striking cap surrounding and engaging with the stem extension collar and made of expanded plastics material which has the property of shrinkage, characterised
 25 in that said stem extension collar has outside dimensions which are less at a section adjacent said flared stems than at a section more remote from said flared stems.
- 30 2. A method of manufacturing a shuttlecock having a moulded skirt structure comprising a flared array of stems supporting the vane area of the shuttlecock at the wider end of said array of stems and a stem extension collar extending from the narrower end of said
 35 array of stems away from said vane area, characterised in the steps of forming said stem extension collar with outside dimensions which are less at a section adjacent said flared

stems than at a section more remote from said flared stems, applying a striking cap made
 40 of expanded plastics material which has the property of shrinkage to surround said stem extension collar and allowing the expanded plastics material of said striking cap to shrink
 45 to engage said stem extension collar.

3. A shuttlecock according to Claim 1 or a method according to Claim 2 in which said stem extension collar comprises a hollow tube having its end remote from said flared stems
 50 rolled over outwardly to form a rim.

4. A shuttlecock according to Claim 1 or a method according to Claim 2 in which said stem extension collar comprises a hollow tube having its end remote from said flared stems
 55 flared outwardly.

5. A shuttlecock according to Claim 1, 3 or 4 or a method according to Claim 2, 3 or 4 in which said striking cap is made of expanded polyvinyl chloride.

6. A shuttlecock substantially as herein described with reference to Figures 1 and 2 or modified as described with reference to Figure
 60 3 of the accompanying drawings.

7. A method of manufacturing a shuttlecock substantially as described with reference to
 65 Figures 1 and 2 or modified as described with reference to Figure 3 of the accompanying drawings.

8. A shuttlecock when manufactured by a method according to any of Claims 2 to 5 or 7. 70

For and on behalf of
 THE CARLTON TYRE SAVING
 COMPANY LTD.
 W. C. Carlton,
 Director.

